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Atmospheric Measurement Techniques Discussions

Interactive comment on "Feasibility of polarized all-sky imaging for aerosol characterization" *by* A. Kreuter and M. Blumthaler

Anonymous Referee #1

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General comments

All-sky polarimetry is in principle a powerful technique to rapidly determine aerosol properties. The paper describes an image analysis technique to analyse polarization images of the sky, using Zernike polynomials.

This is a technically oriented paper on an analysis method of all-sky polarimetry. The physics in the paper is very limited. I therefore propose to change the paper into an AMT Technical Note.

The paper does not describe the polarization imaging itself, but only the analysis technique. Therefore, I propose that the title of the paper is changed to better reflect its

contents, e.g.: "Analysis method of polarized all-sky images for aerosol characterization using Zernike polynomials."

Specific comments

Introduction:

- l. 14: "alternative method of measuring the sky radiance": alternative to what? All-sky imaging is not new, see the many references. This paper does not describe a measurement technique but only an analysis technique. In Sect. 1 it should be described what is really new in this paper. E.g. what is new as compared to Kreuter et al. (2009, 2010)?

- l. 23: Please clearly indicate that the broadband wavelength resolution is a disadvantage of this technique.

- The introduction should also give the structure of the paper.

Abstract:

- The abstract says: "... independent of calibration and robust againt noise": that sounds too good to be true. Please give quantitative information on the errors of this technique.

- What is the spectral capability of this technique?

p. 8816:

l. 23: limited by ground albedo: please clarify

l. 23/24: 2x remote sensing.

- please mention that groundbased remote sensing of aerosols is important for process studies and for validation of satellite remote sensing.

p. 8817:

first paragraph:

- in different viewing angles > at different viewing angles

- distribution > angular distribution

- wavelength bands > in different wavelength bands

- the vertical plane > which is the vertical plane

- . The so-called almucantar is a scan > , and the almucantar, which is a scan

l. 7: incorrect; the solar zenith angle is 90 deg minus the elevation angle of the sun

p. 8818:

l. 22: this zero albedo assumption is not realistic. What is the effect on the results?

p. 8819:

- why do you use a Monte Carlo method if you only want to model radiative transfer in a plane parallel atmosphere? The error characteristics of MC are quite poor.

- l. 5: what is the numerical MC noise in Q and U?

- l. 9: what is the AOT in this map?

- l. 9: so that > such that

- l. 13-20: please clarify this definition of polarization reference with a figure, since this is an essential point

- l. 22-23: this description is the other way round than what is given by Eq. 2: there you rotate from the fixed to the corotating reference plane.

p. 8820:

- l. 1 – 8: the description of the Figs. 1-3 is generally unclear. What is contained in them ? Q and U, or Qr and Ur ? Please also indicate in the figure legends themselves

what is shown: Q and U or Qr and Ur.

- l. 11: say that normalization largely removes this problem

- l. 11: because > because of

- l. 26: please explain more and give an equation for the Zernike polynomials. This is an essential part of this paper.

p. 8821:

- l. 12: using the degree of polarization sqrt (Qrˆ2 + Urˆ2)/I is more logical than (Qr + Ur)/I since it is a physical parameter not depending on the reference plane.

p. 8822: explain AOD acronym

p. 8823:

- l. 10: this low SSA is not realistic for absorbing soot aerosols. Did you only use OPAC results, or did you also do Mie calculations yourself?

p. 8825:

- last line: airmass

p. 8826:

- l. 10-12: this model simplification raises quite some questions. Firstly, you should mention this important limitation much earlier, in sect. 1 or sect. 2. Secondly, what would be the effect on the FV-space? Is the method still useable? Did you verify this?

p. 8829:

- l. 14: Spectrosc. Ra. > Spectrosc. Rad. Tr.

Figures:

- Figs. 2 – 3: give the degree tick marks and values on all the axes.

Figure captions:

Fig. 1:

- add = sign: SZA=60, AOD=0.2

- Please specify the AOD at 650 nm, which is the relevant wavelength

Fig. 5: use capitals for aerosol types. Which three scalings are meant?

Fig. 6: trajectories > curves

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8815, 2012.